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by

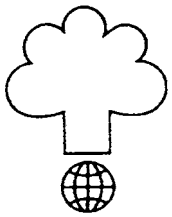
Anders Ræbild[1], Lars Graudal[1] and R. Jambulingam[2]

Tamil Nadu Agricultural University[2] (TNAU), India

Forest Research Institute and Colleges, Dehra Dun, India

Food and Agriculture Organization, Rome

Danida Forest Seed Centre[1], Denmark



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Cover photo: Two different provenances of *Prosopis juliflora* in the trial. Above a bushy creeping type from Honduras (49/83 Comayagua). Below an erect highly productive form (20/82) of unknown origin (Unknown 4). Phot. Anders P. Pedersen 1992.

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Forest & Landscape Denmark
Kongevejen 11, DK-2970 Hørsholm, Denmark
Phone: +45-35281503 Fax: +45-35281517
Email: sl@kvl.dk
Web Site: www.SL.kvl.dk

and/or be downloaded from the DFSC homepage:
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From 1st January 2004, Danida Forest Seed Centre (DFSC) is part of the Danish Centre for Forest, Landscape and Planning, which is an independent centre under the Royal Veterinary and Agricultural University (KVL), in short ***Forest & Landscape Denmark.***

Forest & Landscape is a merger between DFSC, the Danish Forestry College, the Danish Forest and Landscape Research Institute and the Department of Economics and Natural Resources at the Royal Veterinary and Agricultural University of Copenhagen (KVL).

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Danida Forest Seed Centre (DFSC) is a Danish non-profit institute which has been working with development and transfer of know-how in management of tree genetic resources since 1969. The development objective of DFSC is to contribute to improve the benefits of growing trees for the well-being of people in developing countries. DFSC's programme is financed by the Danish International Development Assistance (Danida).

Preface

This report belongs to a series of analysis reports originally published by the Danida Forest Seed Centre. The series has served as a place for publication of trial results for the Centre itself as well as for our collaborators. With the integration of DFSC into the Danish Centre for Forest, Landscape and Planning, the series will be taken over by *Forest & Landscape* publication series.The reports are available from the *Forest & Landscape* publication service and online from the web-site www.dfsc.dk.

The scope of the series is in particular the large number of trials from which results have not been made available to the public, and which are not appropriate for publication in scientific journals. We believe that the results from these trials will contribute considerably to the knowledge on genetic variation of tree species in the tropics. Also, the analysis reports will allow a more detailed documentation than is possible in scientific journals.

This report presents results within the framework of the 'International Series of Trials of Arid and Semi-Arid Zone Arboreal Species', initiated by the FAO. Following collection and distribution of seed between 1983-87, a large number of trials were established by national institutions during 1984-1989. An international assessment of 26 trials took place from 1990 to 1994. DFSC was responsible for the reporting of this assessment.

This trial was established and maintained by Tamil Nadu Agricultural University (TNAU), Forestry Faculty, Coimbatore in collaboration with Forest Research Institute & Colleges (FRI), Dehra Dun, India. The assessment team consisted of Vinod Kumar (FRI), R. Jambulingam (TNAU) , and Anders Pedersen (DFSC).

The authors wish to acknowledge the help of the personnel at TNAU/FRI with the establishment, maintenance and assessment of the trials, and thank the personnel of DFSC for their help with the data management and preliminary analyses. Drafts of the manuscript were commented on by Marcus Robbins, consultant to FAO.

Abstract

This report describes results from a trial with 13 provenances of the species *Acacia tortilis* and *Prosopis chilensis*. Two provenances of *A. difficilis* and *A. planifrons* were included as well. Geographically the provenances span widely, being from Sudan, Israel, Yemen, Honduras, Australia and India. The trial was established with a spacing of 2 x 2 metres at Mettupalayam, India, between 1985 and 1987, and was assessed after 5 years in 1992. Being a trial without replications and with provenances planted in different years, it has more the character of a demonstration trial, and it is difficult to give recommendations on the choice of provenance.

Survival was high, varying between 60 and 100 %. A provenance of *P. juliflora* had the fastest growth, corresponding to 11 t ha^{-1} y^{-1}. The identity of this provenance is not known. The other provenances had a considerably lower production. *A. difficilis* and *A. planifrons* were at the high end, whereas within *A. tortilis* and *P. juliflora* there was a large variation between provenances. Data indicated that *A. tortilis* subsp. *raddiana* had a better performance at the site than had *A. tortilis* subsp. *spirocarpa*.

Contents

1. Introduction

This report describes the results from trial no. 18 in a large series of provenance trials within the 'International Series of Trials of Arid and Semi-Arid Zone Arboreal Species'. The main goals of the series were to contribute to the knowledge on the genetic variation of woody species, their adaptability and productivity and to give recommendations for the use of the species. The species included in this series of trials are mainly of the genera *Acacia* and *Prosopis*. A detailed introduction to the series is given by DFSC (Graudal *et al.* 2003).

The trial is a combined species and provenance trial of *Acacia* and *Prosopis*. Since there are no replications of the provenances and the provenances are planted through a period of three years, the trial has character of demonstration plot. However, although no statistical tests are performed, the trial may give useful information on the behavior of the provenances at the site.

Acacia tortilis, which is the main species in this trial, is widespread in the Northern Africa including the Sahel, Eastern and Southern Africa and Arabia (Ross 1979, Brenan 1983, von Maydell 1986, Fagg & Barnes 1990). Provenances from Sudan, Yemen and Israel are represented with a landrace from India. Brenan (1983) distinguishes four subspecies, of which at least two are represented in this trial (the subspecies is not registered for three of the provenances). These two are subspecies *raddiana* and *spirocarpa*. *Raddiana* is found in Northern Africa and parts of the Arabic peninsula, whereas *spirocarpa* is found in Eastern Africa. The subspecies *heteracantha* is found only in Southern Africa and is not represented, whereas the subspecies *tortilis* could be represented: It is found in the north-eastern Africa and on the Arabic peninsula.

Furthermore two provenances of *A. difficilis* and *A. planifrons* are included. These are relatively unknown species on which little information is available in the literature.

Prosopis juliflora is represented with four provenances. One is originally from Honduras, whereas there is no information available on the three other provenances.

2. Materials and Methods

2.1 Site and establishment of the trial

The trial is located at Mettupalayam Forestry Research Station (11°18'N, 76°55'E) in Tamil Nadu, India at an altitude of 300 m. The mean annual temperature is 26.9 °C, and the mean annual rainfall is 612 to 830 mm (DFSC 1994). The dry period is approximately 8 months. Further information is given in the assessment report (DFSC 1994) and summarised in annex 1.

The provenances in the trial were not planted at the same time. Most of the plots were established in October 1986, four plots were planted November 1985 and one plot was planted in October 1987. The date of sowing for the provenances is not known, but for the purpose of calculating annual increments it is assumed that all seedlots were sown in the nursery during the month of May the same year as they were planted.

2.2 Species and provenances

The trial includes a total of 15 provenances. *A. difficilis* and *A. planifrons* are represented with one provenance each, whereas the main species of the trial, *A. tortilis* and *P. juliflora*, are represented with nine and four provenances, respectively. The provenances are listed in Table 1, and seedlot names can be found in annex 2. No information is available on three provenances of *P. juliflora*.

2.3 The experimental design

There are no replications in the trial except for the provenance Madhya Pradesh1, which is planted on two plots. Each provenance is represented by 25 trees planted in a square of 5×5 trees with a spacing of 2×2 m. The layout of the trial is shown in annex 3, and further details are given in DFSC (1994).

2.4 Assessment of the trial

In May 1992 TNAU, FRI and DFSC undertook a joint assessment. The assessment included the following characters:

- Survival
- Health status
- Vertical height
- Diameter of the three largest stems at 0.3 m
- Number of stems at 0.3 m
- Crown diameter

A detailed account of the assessment methods is given by DFSC (Graudal *et al.* 2003), and raw data from the assessment are documented in DFSC (1994). The plot data set, from which the variables presented in this report is taken, is shown in annex 4. This data set includes directly observed values as well as derived variable values.

Table 1. Species and provenances of *Acacia* and *Prosopis* tested in trial no. 18 at Mettupalayam, India.

Provenance	Species	Provenance name	Country of origin	Latitude	Longitude	Altitude (m)	Rainfall (mm)	No. of mother trees	Year of sowing
N.Territory6	*A. difficilis*	Borrolloola, Nt	Australia	16° 21' S	133° 40' E	235			1986
Kerala1	*A. planifrons*	Coimbatore, Tn	India	11° 00' N	76° 57' E	314	790		1986
Israel3	*A. tortilis*	Ein-Hazeva, Arava	Israel	30° 47' N	35° 12' W	100	40	60	1986
Madhya Pradesh1	*A. tortilis*	Jhansi	India	25° 27' N	78° 13' E	440	850		1985
Sudan15	*A. tortilis* subsp. *spirocarpa*	Khartoum, West Nile	Sudan	15° 36' N	32° 33' E	330	165	25	1986
Sudan16	*A. tortilis* subsp. *raddiana*	Khartoum, West Nile	Sudan	15° 36' N	32° 33' E	330	165	25	1986
Sudan17	*A. tortilis* subsp. *raddiana*	Kamlin, Gezira	Sudan	15° 05' N	33° 10' E	380	200	25	1987
Sudan19	*A. tortilis* subsp. *raddiana*	El Geteina, Ed Duim	Sudan	14° 50' N	32° 22' E	500	300	24	1986
Sudan20	*A. tortilis* subsp. *spirocarpa*	Khartoum S, West Nile	Sudan	15° 30' N	32° 20' E	400	150	134	1986
Sudan21	*A. tortilis* subsp. *spirocarpa*	Khartoum N, East Nile	Sudan	15° 50' N	32° 15' E	400	150	30	1986
Yemen3	*A. tortilis*	Ahwar	Yemen	13° 33' N	46° 44' E	200	150	25	1986
Honduras1	*P. juliflora*	Comayagua	Honduras	14° 21' N	87° 37' W	600	880		1986
Unknown2	*P. juliflora*								1986
Unknown3	*P. juliflora*								1986
Unknown4	*P. juliflora*								1986

3. Analysis

3.1 Variables

In this report the following variables are presented:

- Survival
- Vertical height
- Crown area
- Number of stems at 0.3 m
- Basal area of the mean tree at 0.3 m
- Total basal area at 0.3 m
- Dry weight of the mean tree
- Total dry weight

The values are presented on a plot basis, i.e. ratio, mean or sum as appropriate. Survival was calculated as the rate of surviving trees to the total number of trees per plot. Height, crown area and number of stems were calculated as the mean of surviving trees on a plot, as were the basal area and the dry weight of the mean tree. The total basal area and the total dry weight represent the sum of all trees in a plot, expressed on an area basis. Note that the calculations of basal area are based on measurements of the three largest stems per tree. Health data are not presented, as only few trees were damaged, and these were not concentrated on specific provenances.

For the provenance with two replications, Madhya Pradesh1, the values presented are averages of values for the two plots.

Three out of 351 trees had missing observations for diameter, number of stems and crown area. This was not corrected, as the implications of this are believed to be small.

The dry weight values were calculated from regressions between biomass and basal area, established in another part of this study (Graudal *et al.* in prep.). For *A. tortilis* the regression used was

$$TreeDW = e^{(2.711 \times \ln(basalarea) - 2.394)}$$

where *TreeDW* expresses the dry weight of the tree in kg tree^{-1}, and *basalarea* expresses the basal area of the tree in cm^{-2}. For *P. juliflora* the regression was

$$TreeDW = e^{(2.466 \times \ln(basalarea) - 2.036)}$$

No regressions were available for the species *A. difficilis* and *A. planifrons*.

3.2 Analysis

As there were no replicates, no statistical analysis could be performed. However, even if no formal analysis is made, one may still obtain useful information from the trial. Therefore the plot averages or plot sums of the provenances are illustrated graphically for each variable.

4. Results

4.1 Survival

Survival is regarded as one of the key variables when analysing tree provenance trials, since it indicates the adaptability of the provenance to the environment at the trial site. It should be noted that survival reflects only the conditions experienced during the young phase of the tree's life and not necessarily the climatic extremes and conditions that may be experienced during the whole life-span of a tree.

Overall the survival of the trees was high, varying between 60 and 100 % (Fig. 1). The two Indian provenances, Kerala1 and Madhya Pradesh1, had a survival of 100 and 98 %, respectively. Sudan20, Unknown2 and Unknown4 also had 100 % survival. There were no signs of differences between the species, as both *A. tortilis* and *P. juliflora* had provenances with high and low survival.

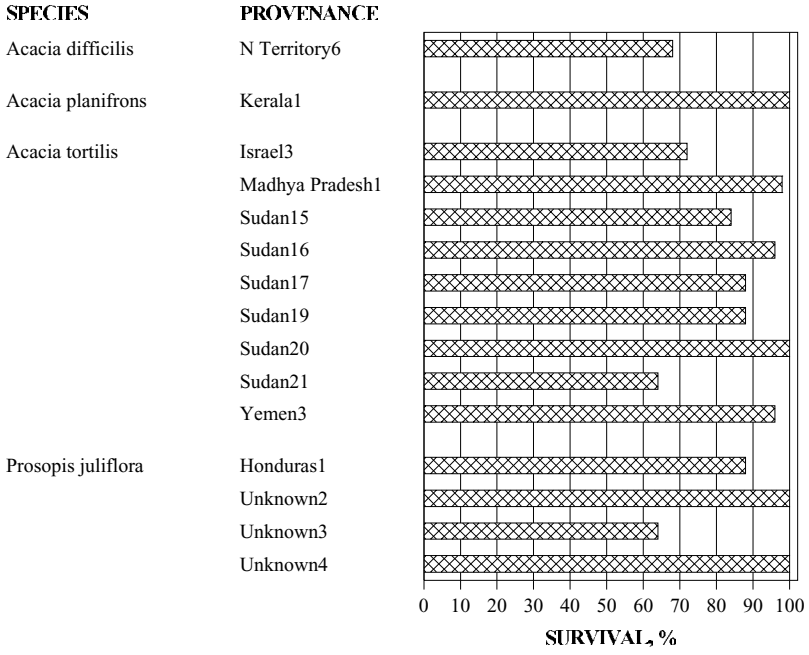

Figure 1. Survival in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

4.2 Height

Height is usually considered an important variable in the evaluation of species and provenances, even though this depends on the main uses of the trees. Apart from indicating productivity, height may also be seen as a measure of the adaptability of trees to the environment, tall provenances/trees usually being better adapted to the site than short provenances/trees. This need not always be true, as there has been cases where trees from tall provenances are suddenly affected by stress and die-off.

The average height of the provenances varied between 1 and 5.5 m (Fig. 2). The provenance of *A. difficilis* was the highest, whereas the provenance of *A. planifrons* was in the intermediate range. In *A. tortilis*, the best provenances were the local Madhya Pradesh1 and the three *raddiana* provenances from Sudan. For *P. juliflora* the highest provenance was Unknown 4, whereas the provenance from Honduras was the smallest. There were no signs of consistent differences between the species *A. tortilis* and *P. juliflora*.

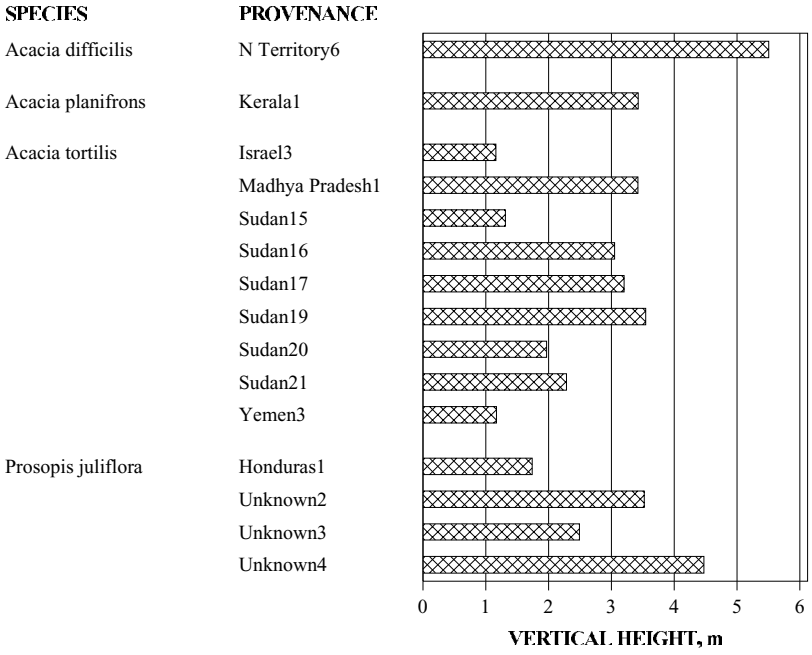

Figure 2. Vertical height in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

4.3 Crown area

The crown area variable indicates the ability of the trees to cover the ground. Crown area is important because of shading for agricultural crops, for evaluating the production of fodder and because of protection of the soil against erosion.

Provenances Unknown2 and Unknown4 of *P. juliflora* had the largest crown areas with 11-12 m^2 $tree^{-1}$. This is large considering that the trees were planted on a distance of only 2 × 2 m. The provenances of *A. difficilis* and *A. planifrons* formed an intermediate group with Madhya Pradesh1, Sudan16, Sudan17 and Sudan19 of *A. tortilis* (Fig. 3). The smallest provenances were all found in *A. tortilis*, consisting of the provenances Israel3, Sudan 15, Sudan20, Sudan21 and Yemen3, having average crown areas of approximately 2 m^2 $tree^{-1}$.

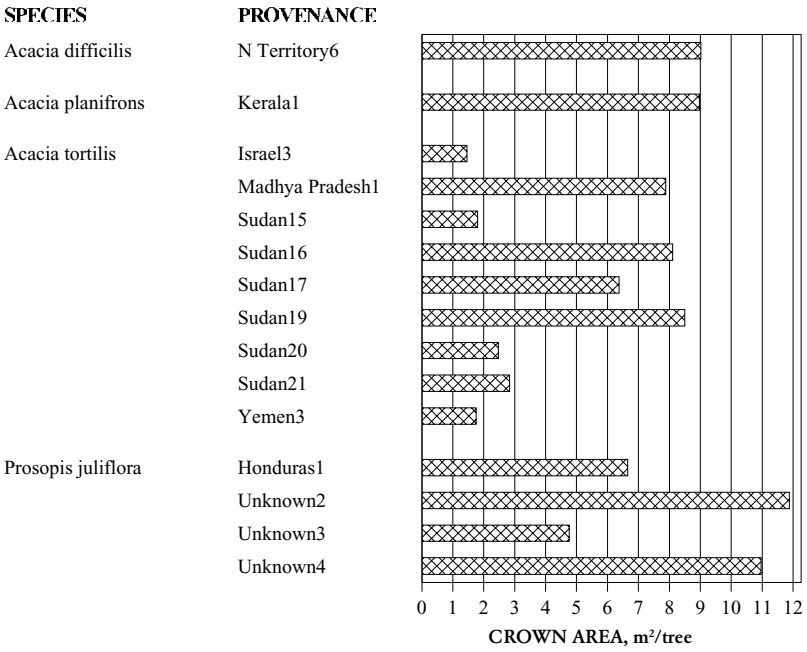

Figure 3. Crown area in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

4.4 Number of stems

The number of stems indicates the growth habit of the species. Trees with a large number of stems are bushy, whereas trees with only one stem have a tree-like growth.

For number of stems the picture was different from the other variables. The largest numbers of stems were found in the provenances Israel3, Sudan15, Sudan20, Sudan21 and Yemen3 of *A. tortilis*. Again Mahdya Pradesh1 and the three *raddiana* provenances formed a group of their own, having lower number of stems. *A. difficilis* and the provenances of *P. juliflora* had numbers of stems varying from 1.5 to 2.5, whereas *A. planifrons* had 3.3 stems tree^{-1} (Fig. 4). A comparison of *A. tortilis* and *P. juliflora* could indicate that the *P. juliflora* has a smaller number of stems. A statistical test demonstrated that this was significant (P=0.01).

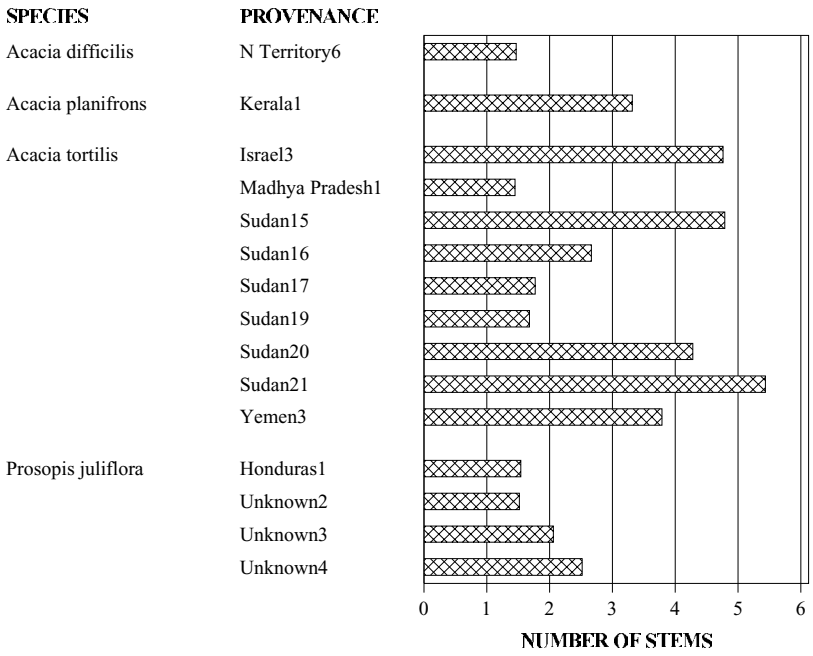

Figure 4. Number of stems in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

4.5 Basal area of the mean tree

The basal area is often used as a measure of the productivity of stands, since it is correlated with the production of wood. The basal area of the mean tree is calculated on the live trees only and gives a measure of the potential basal area production of the provenances if all trees had survived.

Unknown4 of *P. juliflora* had the fastest growth with 70 cm^2 $tree^{-1}$. The provenances of *A. difficilis* and *A. planifrons* had intermediate basal areas, whereas the rest of the provenances were below app. 30 cm^2 $tree^{-1}$. Within *A. tortilis*, Madhya Pradesh1, Sudan16, Sudan17 and Sudan19 again took the lead.

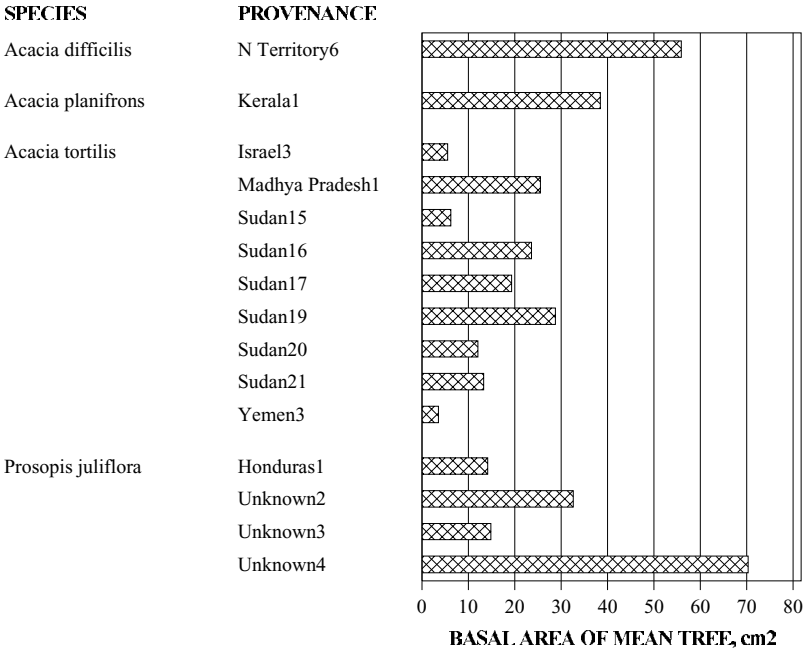

Figure 5. The basal area of the mean tree in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

4.6 Total basal area

In comparison to the basal area of the mean tree, the total basal area accounts for missing trees and is thus a better measure of the actual production on the site.

The largest basal areas occurred in the provenances of *A. difficilis* and *A. planifrons*, and in Unknown4 of *P. juliflora*, which took the lead with 18 m^2 ha^{-1}. The provenances of *A. tortilis* were much more modest with values at or below 6 m^2 ha^{-1}. As usual the fastest growing provenances of this species were Sudan16, Sudan17, Sudan19 and Madhya Pradesh1.

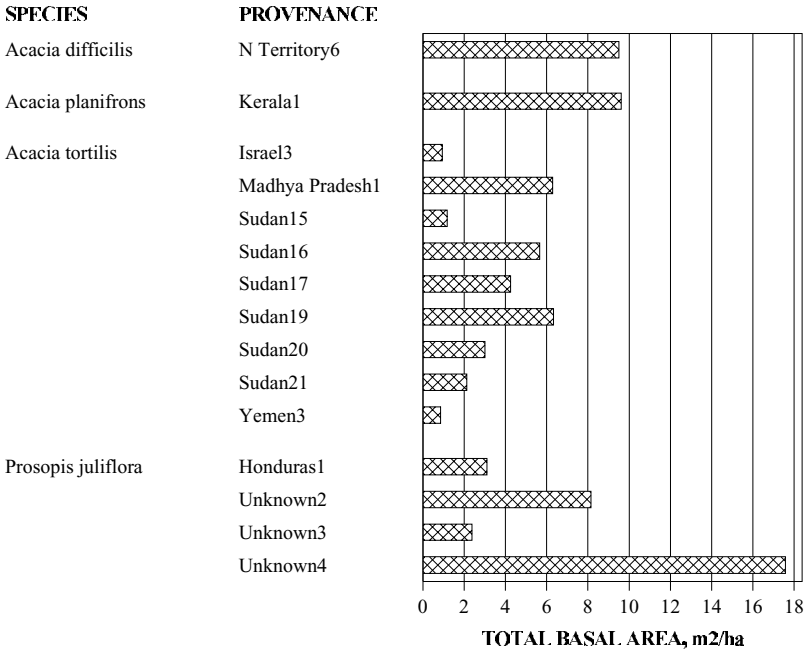

Figure 6. Total basal area in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

4.7 Dry weight of the mean tree

The dry weight of the mean tree is comparable to the basal area of the mean tree in that they both are calculated on the live trees only and thus serve as a measure of the potential production at the site under the assumption that all trees survive. Furthermore, the two variables are linked closely together, as the basis for calculation of the dry weight is the basal area. However, an important difference is that the dry weight includes a cubic term (in comparison to basal area having only a square term), meaning that trees with large diameters are weighted more heavily in this variable. The dry weight of the mean tree is thus the best estimate for the potential production of biomass at the site.

Unfortunately no regressions explaining the correlation between diameter and dry weight were available for *A. difficilis* and *A. planifrons*, and data for these species cannot be presented. The *P. juliflora*-provenance Unknown4 had by far the heaviest trees with an average of 26 kg tree^{-1}. All other provenances had average dry weights of less than 12 kg tree^{-1}. The provenances of *A. tortilis* followed the usual pattern with Madhya Pradesh1 and the three *raddiana* provenances having the largest dry weights.

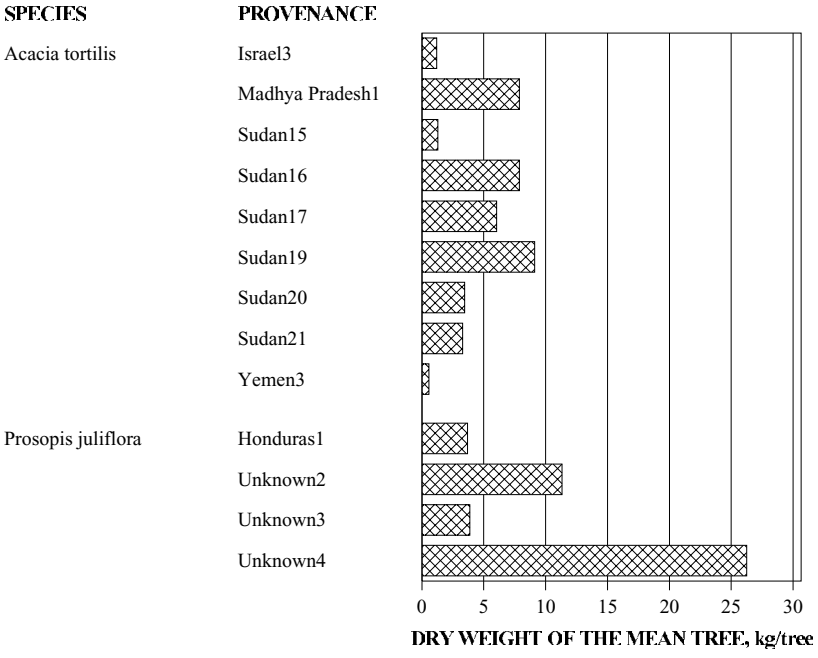

Figure 7. Dry weight of the mean tree in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

4.8 Total dry weight

In parallel with the total basal area, the total dry weight includes missing trees and gives the best measure of the actual production of biomass on the site. Due to lack of biomass regressions, data for *A. difficilis* and *A. planifrons* were not available.

The largest production of dry weight was found in the *P. juliflora* provenance Unknown4. This provenance had a dry weight of 65 t ha^{-1}, which corresponds to an annual production of approximately 11 t ha^{-1} y^{-1}. Apart from Unknown2, the other provenances had a considerably lower production, below 20 t ha^{-1} .

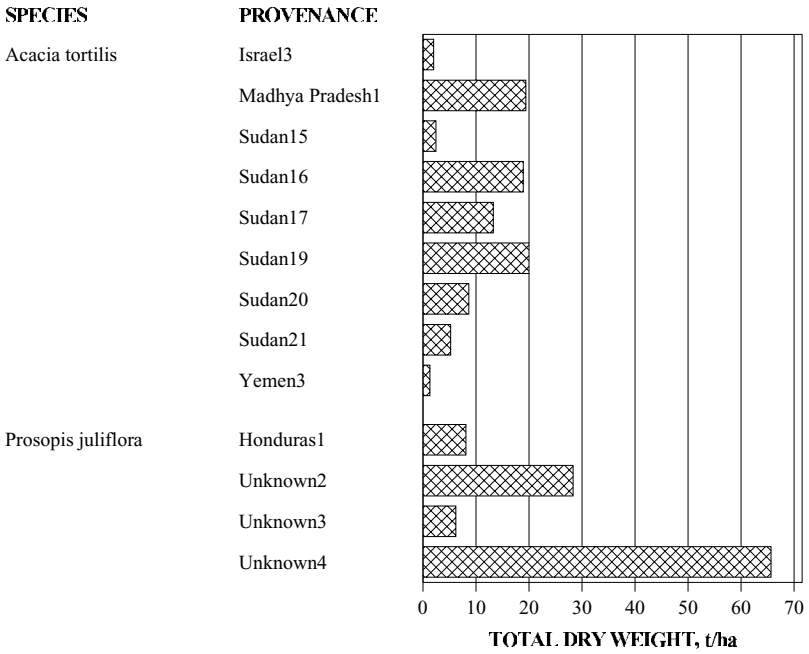

Figure 8. Total dry weight in the *Acacia* and *Prosopis* species and provenance trial at Mettupalayam, India (Trial no. 18 in the arid zone series).

5. Discussion and conclusions

Productivity
Unknown4, the provenance of *P. juliflora* had a production of 11 t per year. This is the highest among all the 26 trials of the arid zone series. Several factors may contribute to this: First, the spacing between trees is very small in comparison to the other trials, meaning that production, at least initially, is higher due to a larger number of plants per area. Second, since there are no replicates, it cannot be rejected that it is due to favourable conditions at the site of the plot, or simply due to random variation. Third, it is possible that the provenance is superior to the others and has an exceptional performance at the site. New trials with replicates could help in evaluating which one is the major factor.

Species differences
Even if there are no replicates of individual provenances, the fact that there are several provenances of *A. tortilis* and *P. juliflora* makes it possible to compare the growth of the two species. Each provenance can be regarded as one replicate of the species. However, it seems that there is a big variation within each species, making it difficult to make generalisations on their behaviour. There are indications that *P. juliflora* has a smaller number of stems, but for the other characters, provenances of the two species were overlapping.

The provenances of *A. difficilis* and *A. planifrons* were at the high end with regard to height, crown area and basal area and had an acceptable performance as judged from the two plots in this trial.

Provenance differences
Since there are no replications in this trial, any recommendation on the choice of provenance should be treated with care. It cannot be excluded that the variation between provenances in the trial is due to differences in the environment or simply because of random variation. Therefore, it would be premature to recommend the provenance Unknown4 for production of woody biomass. This needs to be verified in further trials.

However, as a hypothesis for further work it would be obvious to assume that Unknown4 has production abilities above the average provenance. It is unfortunate that there is no information on the seed sources of three of the *P. juliflora* provenances, especially as what seems to be the best provenance is within this group.

Since at least two groups of provenances of *A. tortilis* are included (subspecies *raddiana* and *spirocarpa*) a comparison of provenances within this species is possible. Here an interesting pattern occurs: The provenances of subspecies *raddiana* seem to be different from subspecies *spirocarpa*, having superior height growth, crown area, basal area and dry weight, and a lower number of stems. The local provenance, Madhya Pradesh1, has much in common with the provenances of subspecies *raddiana*. This seems well in line with the fact that the Indian landraces of *A. tortilis* are believed to be of subspecies *raddiana* (Brenan 1983).

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Annex 1. Description of the trial site

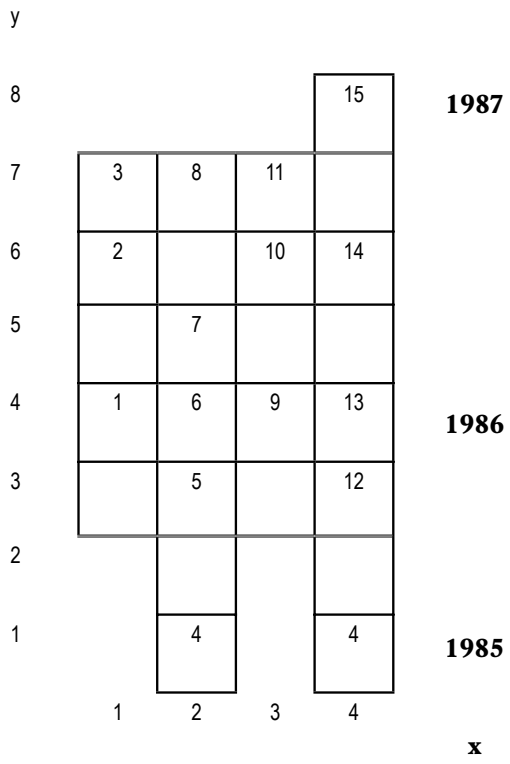
Name of site:	Mettupalayam Forestry Research Station Latitude: 11°18'N Longitude: 76°55'E Altitude: 300 m
Meteorological stations:	Coimbatore (11°00'N, 76°58'E, 409 m (FAO 1987))
Rainfall:	Annual mean (period): 612 mm/year (FAO 1987) 830 (TNAU 1988)
Rainy season:	9-10 (September-October), 4-5 (April-May) Type: Season with dry period (FAO 1987) Length (days): Intermediate 17, wet 52 (FAO 1987)
Dry months/year:	No. of dry months (< 50 mm): 8 No. of dry periods: 1 (2)
Temperature:	Annual mean: 26.9 Coldest month: 19.2 Hottest month: 34.7 Occurrence of frost: 1-3 days per year
Wind:	Speed: 1.9 m/s (FAO 1987)
Topography:	Flat/gentle.
Soil:	Type: Read loam, infertile, pH 7, almost gravel texture Depth: Shallow (solid rock in depth)
Climatic/agroecological zone:	Semi-arid/subhumid
Koeppen classification:	BSh/Aw

Annex 2. Seedlot numbers of provenances tested in trial no. 18

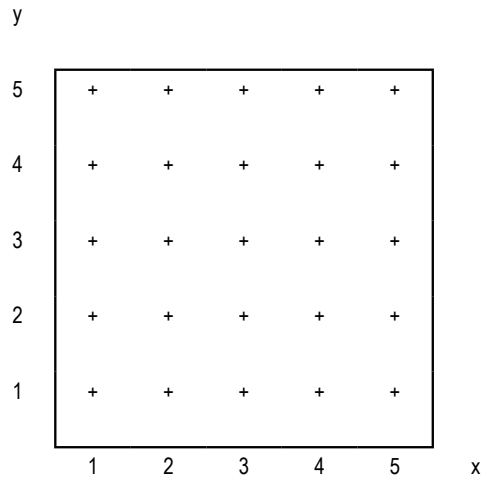
Seedlot numbers				Provenance information							
Provenance	DFSC	Country of origin	Plot	Species	Origin	Country of origin	Latitude	Longitude	Altitude (m)	Rainfall (mm)	No. of mother trees
N.Territory6		14623	5	*A. difficilis*	Borrolloola, Nt	Australia	16 21 S	133 40 E	235		
Kerala1		Mettu2	6	*A. planifrons*	Coimbatore, Tn	India	11 00 N	76 57 E	314	790	
Israel3	1066/82		2	*A. tortilis*	Ein-Hazeva, Arava	Israel	30 47 N	35 12 W	100	40	60
Madhya Pradesh1		Mettu1	4	*A. tortilis*	Jhansi	India	25 27 N	78 13 E	440	850	
Sudan15	1045/82	3/82	1	*A. tortilis subsp. spirocarpa*	Khartoum, West Nile	Sudan	15 36 N	32 33 E	330	165	25
Sudan16	1047/82	1/1982	12	*A. tortilis subsp. raddiana*	Khartoum, West Nile	Sudan	15 36 N	32 33 E	330	165	25
Sudan17	1159/83	5/1983	15	*A. tortilis subsp. raddiana*	Kamlin, Gezira	Sudan	15 05 N	33 10 E	380	200	25
Sudan19	1335/84	5/1984	8	*A. tortilis subsp. raddiana*	El Geteina, Ed Duim	Sudan	14 50 N	32 22 E	500	300	24
Sudan20	1340/84	5/1984	10	*A. tortilis subsp. spirocarpa*	Khartoum S, West Nile	Sudan	15 30 N	32 20 E	400	150	134
Sudan21	1341/84	6/1984	9	*A. tortilis subsp. spirocarpa*	Khartoum N, East Nile	Sudan	15 50 N	32 15 E	400	150	30
Yemen3	1065/82	(4)	3	*A. tortilis*	Ahwar	Yemen	13 33 N	46 44 E	200	150	25
Honduras1		49/83 (OFI ?)	7	*P. juliflora*	Comayagua	Honduras	14 21 N	87 37 W	600	880	
Unknown2		11/84	13	*P. juliflora*							
Unknown3		15/82	11	*P. juliflora*							
Unknown4		20/82	14	*P. juliflora*							

Annex 3. Layout of the trial

Layout of plots in the field: N



Individual tree positions in each plot:



Annex 4. Plot data set

The plot numbers correspond to the seedlots in the layout of the trial, see annex 3. Note that there are two plots for the provenance Madhya Pradesh1.

Provenance	Species	Plot	Plotx	Ploty	Survival	Height	Crown area	Number of stems	Basal area of mean tree	Total basal area	Dry weight of mean tree	Total dry weight
					%	m	m^2 $tree^{-1}$	no. $tree^{-1}$	cm^2 $tree^{-1}$	m^2 ha^{-1}	kg $tree^{-1}$	t ha^{-1}
N Territory6	A. difficilis	5	2	3	68	5.51	9.02	1.47	55.88	9.50		
Kerala1	A. planifrons	6	2	4	100	3.43	8.97	3.32	38.44	9.61		
Israel3	A. tortilis	2	1	6	72	1.16	1.46	4.76	5.55	0.94	1.19	2.02
Madhya Pradesh1	A. tortilis	4	2	1	100	3.86	9.30	1.36	30.52	7.63	9.79	24.48
Madhya Pradesh1	A. tortilis	4	4	1	96	2.99	6.46	1.54	20.62	4.95	5.98	14.34
Yemen3	A. tortilis	3	1	7	96	1.17	1.76	3.79	3.57	0.86	0.56	1.35
Sudan16	A. tortilis subsp. raddiana	12	4	3	96	3.05	8.11	2.67	23.62	5.67	7.88	18.92
Sudan17	A. tortilis subsp. raddiana	15	4	8	88	3.20	6.38	1.77	19.33	4.25	6.03	13.28
Sudan19	A. tortilis subsp. raddiana	8	2	7	88	3.55	8.50	1.68	28.79	6.33	9.11	20.05
Sudan15	A. tortilis subsp. spirocarpa	1	1	4	84	1.31	1.80	4.79	6.24	1.18	1.29	2.45
Sudan20	A. tortilis subsp. spirocarpa	10	3	6	100	1.97	2.47	4.28	12.06	3.01	3.45	8.63
Sudan21	A. tortilis subsp. spirocarpa	9	3	4	64	2.29	2.84	5.44	13.32	2.13	3.29	5.27
Honduras1	P. juliflora	7	2	5	88	1.74	6.65	1.55	14.15	3.11	3.69	8.13
Unknown2	P. juliflora	13	4	4	100	3.52	11.88	1.52	32.62	8.15	11.33	28.32
Unknown3	P. juliflora	11	3	7	64	2.49	4.77	2.06	14.87	2.38	3.88	6.20
Unknown4	P. juliflora	14	4	6	100	4.47	10.96	2.52	70.29	17.57	26.25	65.63